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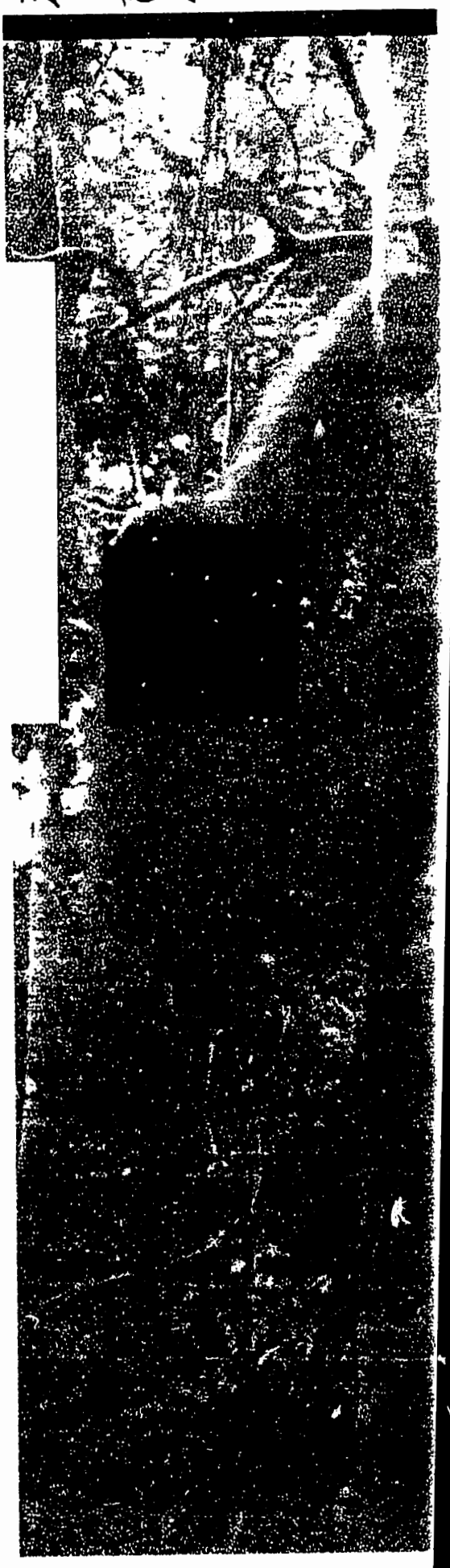

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IMPLEMENTING POLLUTION PREVENTION AT THE U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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SUMMARY

In the past decade, many developed countries have shifted their waste management approach from end-of-the-pipe methods to the more proactive approach of reducing pollution at the source. Improved technology, raw material substitution, and simply better housekeeping and maintenance techniques all serve to reduce waste *prior* to production. Generating less waste can decrease waste management costs, improve efficiency, reduce risks to public health, and enhance environmental quality.

Pollution prevention offers the same benefits for developing countries that have been experienced in the U.S. and other developed countries. Developing countries have an opportunity to base future growth on these clean technologies and the techniques of pollution prevention. The U.S. Agency for International Development (USAID), in cooperation with other international development organizations, is in an excellent position to assist host countries with evaluating and implementing pollution prevention as an alternative to waste management and control, or to environmental deterioration.

This report provides an overview of the techniques and benefits of pollution prevention as experienced by the U.S. It suggests ways USAID can draw from this experience to make prevention possible in recipient countries. The report distinguishes between the pollution control and pollution prevention approaches. It identifies seven factors or conditions that contribute to the success of pollution prevention and discusses how USAID can help establish these conditions through policy dialogue, technology transfer, and institution building. Together, these support techniques can help design and implement a comprehensive strategy by influencing all sectors of society and all environmental media. Finally, several projects are suggested for the Agency to undertake.

SUPPORT OPTIONS FOR POLLUTION PREVENTION INITIATIVES

	Support Options		
Factors Affecting Pollution Prevention Implementation	**Policy Dialogue**	**Technology Transfer**	**Institution Building**
Environmental Awareness	1) Provide information and training for policy-makers.	1) Identify wastes and their impact through the audit process.	1) Raise awareness for all sectors through training and outreach services.
Technological Capabilities		1) Transfer prevention technologies. 2) Provide training for technology use and maintenance. 3) Supply information on materials handling procedures.	1) Provide training for technology use and maintenance. 2) Raise awareness of occupational hazards.
Policy Framework	1) Advocate removal of policy distortions. 2) Establish regulatory and market based incentives.		1) Develop skills for policy making (e.g., risk/impact analyses, resource accounting).
Enforcement Capabilities	1) Identify enforcement needs required for compliance.	1) Transfer pollution detection/monitoring devices to verify compliance.	1) Develop skills to conduct compliance audits.
Data Management	1) Identify data requirements for policy planning and enforcement.	1) Develop a system to house and analyze data. 2) Transfer pollution detection devices to collect environmental data.	1) Conduct workshops on using data to promote pollution prevention.
Financial Resources	1) Advocate revenue raising policy options. 2) Provide funding assistance conditional on policy reform.	1) Reduce operating costs while increasing productivity. 2) Provide USAID funded training/outreach services. 3) Offer discounted technologies.	1) Offer USAID funded training/outreach services.
Incentives	1) Encourage government leadership role. 2) Advocate incentive programs(e.g., financial rewards, positive recognition).	1) Reduce operating and other costs, identified in the audit process.	1) Heighten public awareness and thus demand for clean products and legislative protection.

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CHAPTER ONE:
INTRODUCTION

Overview

In the past decade, the United States and other developed countries have begun to shift their waste management approach from pollution control ("end-of-pipe") regulations to the more proactive approach of source reduction or pollution prevention. Improved technology, raw material substitution, and simply better housekeeping and maintenance all serve to reduce waste *before* production. Generating less waste can decrease costs, improve efficiency, reduce risks to public health, and enhance environmental quality.

The U.S. has successfully implemented pollution prevention in many cases. However, to prevent further irreversible damage to the environment, the concept of pollution prevention should be promoted globally. In USAID host countries—particularly where rapid population growth, urbanization and industrialization can have drastic effects on the environment and public health—pollution prevention can play an important role.

Rapid economic expansion in many developing countries offers an opportunity to base future growth on clean technologies and the techniques of pollution prevention. USAID, in cooperation with other international development organizations is in an excellent position to help introduce pollution prevention as an alternative to conventional waste management.

The purpose of this working paper is to provide an overview of the U.S. approach to pollution prevention, identify the conditions necessary to make pollution prevention possible in developing countries, and suggest how USAID can foster these conditions. Specifically, it will focus on policy dialogue, technology transfer, and institution building as means of fostering pollution prevention in developing countries.[1]

USAID officials, environmental professionals and policy analysts involved in promoting sustainable environmental management can benefit from this report. It is important to understand the technological and policy options available for pollution prevention, strategies for implementing these options, and potential barriers to implementation. This paper will provide some insight on these issues, and present some possibilities for USAID projects or initiatives.

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[1]Throughout this report the terms "developing country" and "host country" are both used in reference to countries receiving USAID assistance. In discussions of economic and growth trends, developing country is the appropriate term. However, in reference to pollution prevention, "host country" is more appropriate since the techniques discussed are applicable to the newly industrialized and Eastern European recipients of USAID assistance as well as the developing country recipients.

Economic Trends in Developing Countries

While some developing countries are facing economic and political stagnation or deterioration, others are experiencing dramatic rates of economic growth. Many are adopting advanced industrial technologies, diversifying industrial production, and moving towards capital- and materials-intensive industries. Although developing countries produce less than 20 percent of the world manufacturing output, their production and exports have been growing faster than those of developed countries since the 1960's (Erocal, 1991).

Despite industrial advances and growth of gross domestic product (GDP), most developing countries have not experienced the full benefits of economic growth. Depending on the path of development and the strength of the economy, a number of pressures—including rapidly expanding populations, high rates of inflation and rising levels of foreign debt--can offset economic gains.

The relative importance of these problems varies depending on the developing country of concern. For example, sub-Saharan Africa has been experiencing some of the highest population growth rates in the world in the last 25 years, as well as slow and even declining per capita GNP growth (WRI, 1992). In addition, the last ten years have seen an explosion of the Third World debt crisis, which has crippled the economic growth of many countries: foreign debt in many cases has significantly exceeded national income (WRI, 1992). In eastern European countries that are in transition from a socialist to a more market-based economy, high inflation may be a more important barrier to economic growth than either debt or population growth.

An understanding of the country-specific barriers to sustainable economic growth will strengthen any effort to relieve pressure on environmental resources.

Consequences of Unsustainable Development

Environmental Consequences

In both developed and developing countries, environmental degradation is often the result of rapid, poorly planned economic growth that does not incorporate accurately priced environmental resources. Developing countries are introducing industries and agricultural techniques, often without regard to the environmental consequences. There is a need for additional technology, training, and regulatory frameworks. A long-term perspective is necessary for sustainable growth, or environmental quality will continue to deteriorate at an alarming rate.

In rural areas, increased population and the resulting pressure placed on the environment has reduced the production potential of agricultural lands. Overgrazing and overcropping have stripped the land of

nutrients. Misuse and overuse of pesticides have contaminated waterways and poisoned fish and other wildlife. Poorly managed logging and slash-and-burn cultivation have led to soil erosion, sedimentation, and increased flooding.

Urban areas of developing nations present their own set of environmental problems. Growing concentrations of people, commerce, and industry have increased the demand for waste management services far beyond government's ability to provide. In fact, an estimated 30 to 50 percent of solid waste generated in cities goes uncollected. Many urban sewage systems are also inadequate. In India, only one-third of the urban population has sewage services available to them (Erocal, 1991). These deficiencies in urban waste management and the resulting environmental problems can only grow worse as migration to cities continues.

Environmental degradation has effects that reach far beyond national borders. Developing countries generate roughly 45 percent of human contributions to the greenhouse effect (Speth, 1990). Deforestation and the burning of fossil fuels contribute to world-wide problems of acid rain, global warming, and loss of wildlife species. Developing countries contain the largest share of the world's plant and animal species, and yet habitat destruction places one quarter to one half of these in danger of extinction (Stoel, 1988). Clearly, both developed and developing nations must find ways to provide for their citizens without destroying the resource base upon which we all depend.

Human Health Consequences

The environmental consequences of unsustainable development have direct effects on human health. Only about a quarter of the people who live in developing countries have access to clean water. The World Health Organization estimates that 75 percent of all sickness and 80 percent of childhood deaths are related to unsafe and inadequate water supplies. Air pollution is another serious health problem. In Bombay, for example, where the level of sulfur emissions from industrial facilities is extremely high, breathing impairment is the largest cause of death (Erocal, 1991). Urban smog from automobile emissions also poses a serious health hazard. It is often difficult to determine the proportional contributions of poorly planned, accelerated development and population increases. However, both contribute significantly to environmental degradation.

Third World populations may be more susceptible to the negative effects of environmental contaminants, given overall poorer health status, higher levels of malnutrition, and inadequate medical care. Lack of education and illiteracy often leads to misuse of hazardous substances, such as pesticides.

Given the number of problems associated with environmental degradation, USAID and other donor agencies could have a significant impact by targeting these problems at their source. Promoting pollution prevention in developing countries would be one of the most effective strategies for reducing the human health and environmental problems associated with pollution.

Organization and Scope of Report

This report provides an overview of the techniques and benefits of pollution prevention as experienced by the U.S. It suggests ways USAID can draw from this experience to make prevention possible in recipient countries. Chapter Two distinguishes between the pollution control and pollution prevention approaches to waste management and addresses the advantages and disadvantages of each. Chapter Three discusses how developing countries can benefit from the U.S. experience with pollution prevention, the conditions which affect the potential for pollution prevention in developing countries, and how USAID can help promote these conditions.

Chapters Four, Five, and Six discuss the use of policy dialogue, technology transfer and institution building as means of fostering pollution prevention. Principles and examples of each technique are provided, and the suitability of various options are analyzed. These intervention techniques are widely applicable to USAID's broad range of assistance programs. They are not limited to a specific sector of production or geographic region, but rather can be tailored to address the environmental problems of most USAID-assisted countries.

Finally, Chapter Seven suggests projects for the Agency to consider undertaking.

CHAPTER TWO:
FROM POLLUTION CONTROL TO POLLUTION PREVENTION—
THE U.S. EXPERIENCE

Overview

Pollution control ("end-of-pipe" treatment) and pollution prevention exemplify two contrasting approaches to waste management. Pollution control approaches manage the treatment of wastes after they have been generated. The pollution prevention approach is fundamentally different. It entails reducing the quantity and toxicity of wastes at the source, before wastes are generated.

The pollution control approach has typically been enforced through command and control regulations. Pollution prevention can also be encouraged or mandated through command and control mechanisms. However, preventing pollution at the source or within the production process can lead to substantial economic benefits for both the public and private sector by reducing waste management and control costs. This creates the opportunity to encourage pollution prevention through market-based incentives.

This chapter provides a review of the two approaches to waste management as experienced in the United States. The two approaches are compared in Table 2-1. Chapter Four discusses in detail the advantages of the available policy tools. Although the definitions and techniques discussed in this chapter are not all applicable to conditions in developing countries, they provide an important foundation to draw from in designing an appropriate approach.

Waste Reduction and Treatment Through the Pollution Control Approach

Historically, end-of-pipe waste treatment has been the main strategy employed by government to affect environmental quality. This section will describe the development of this approach, the U.S. federal policies aimed at achieving pollution control, and the advantages and disadvantages of a control strategy for each sector: government, industry, and society.

Overview of U.S. Federal Policies

The 1960's saw a rise in environmentalism in the U.S. Increasing awareness of environmental degradation and risks to public health due to industrial waste prompted demands for action. The U.S. government responded with a series of regulations to control waste discharges, and a monitoring and enforcement system.

TABLE 1. COMPARISON OF END OF PIPE AND POLLUTION PREVENTION APPROACHES

	Pollution Control	Pollution Prevention
Advantages		
Government	1) provides framework for data collection and monitoring needed to evaluate waste streams and effectiveness of control measures 2) allows maximum government control for specific wastes and regions	1) reduces expenditure on implementing, monitoring, and enforcing end-of-pipe regulations
Industry	1) administers control requirements in equitable manner 2) requires only those production changes necessary to meet established standards	1) reduces production and waste disposal costs 2) improves image 3) allows flexibility/innovation in selecting waste reduction technology
Society	1) provides data on local polluters and wastes released 2) reduced exposure to regulated pollutants 3) prevents inappropriate facility siting	1) improves environmental quality 2) lowers health risks 3) promotes efficiency in resource 4) improves product quality
Disadvantages		
Government	1) requires knowledge of industry specific wastes and effective control technologies 2) requires comprehensive and costly monitoring and enforcement initiatives	1) requires time consuming and costly training and technical assistance 2) involves monitoring and enforcement expenses
Industry	1) limits flexibility in selecting appropriate control technology 2) increases production costs 3) requires training or new expertise	1) may increase production costs 2) involves risk and uncertainty of new technologies
Society	1) limits control over environmental quality due to cross-media transfers 2) may reduce employment in the waste treatment & disposal industries 3) increases prices	1) may cause unemployment in certain industries due to reorientation of production processes

Standards are the most common and direct policy instruments used by the government to control waste effluent, emissions, or discharges. Standards define environmental quality targets and specify amounts or concentration of releases that allow the target to be met. Types of standards include: ambient environmental quality standards, effluent or emission standards, technology-based standards, performance standards, product standards, and process standards. Each type of standard provides a reference point for evaluation, or a target for legislative action and control. Other policy instruments to control pollution include permits, licenses, and land and water use controls.

The standards legislated in the Clean Air Act, Clean Water Act, and the Resource Conservation and Recovery Act of the 1970's all imply end-of-pipe treatment. Each of these acts defines strict standards for industrial air emissions, wastewater discharges, and the treatment and disposal of hazardous waste. To comply with these regulations, industry may be required to add treatment technologies to their existing processes. Failure to comply may result in penalties or prosecution.

Advantages of Approach

Government. The pollution control approach gives regulators the authority to control emissions and production processes to achieve environmental goals. If the fines for noncompliance are high enough to alter behavior and an effective enforcement system is in place, regulators can be relatively sure that the goals for a given pollutant will be met.

Another important benefit of waste treatment is that it establishes a framework for collecting industry and environmental data. These data can then be used to evaluate the effectiveness of various policy options and to set future priorities.

Industry. For the most part, industry sees waste treatment as a costly burden. One positive aspect, however, is that this approach to waste management is generally considered equitable. That is, all members of an industrial class regardless of facility age or size are expected to meet the same criteria.

Society. Waste treatment, reduction, or control offers society the benefit of improved environmental conditions. Regulations may be employed to restrict the release of substances that present a health risk to the public, and may also be used to prevent inappropriate facility siting in overdeveloped or environmentally fragile regions. Society may also take advantage of the data collected by government agencies: these data are a valuable resource for citizens to learn about nearby industrial facilities and the characteristics of their releases.

Disadvantages of Approach

Government. The administrative and enforcement costs of pollution control initiatives are immense for the regulator. Before issuing a regulation, the regulator must gather detailed industry-specific information on production processes, wastes, and the suitability of various pollution control devises. The data collection, site inspections, and environmental testing required for enforcement of control measures are also time-consuming and expensive.

Industry. To comply with control regulations, industry is often required to make processing changes or attach treatment technologies to their existing operations. Many of these are costly and, so, can place a firm at a competitive disadvantage. In some cases, the costs may result in loss of employment or plant closure.

Society. For the public, the drawback of pollution control is its limitations in improving environmental quality. Pollution control regulations address specific problems by setting standards for each medium: water, land, and air. However, many of the technologies used to comply with these standards create wastes of their own which then require disposal in another medium. For example, the use of scrubbers to treat toxic air emissions generates toxic solids which then must be disposed of on land. Pollution control technologies may reduce emissions in specific areas; however, due to cross-media transfers, the net positive effect on the environment may be minimal.

Pollution control has also been criticized as ineffective in addressing many forms of waste. For examples, the approach does not deal effectively with nonpoint source pollution (such as urban and agricultural runoff), solid waste disposal, and global environmental problems (such as stratospheric ozone depletion and climate changes) (Bernstein, 1991).

The Pollution Prevention Approach

The shortcomings of pollution control and continued environmental degradation led to the development of pollution prevention as the strategy of the 1990's. President Bush, signing the 20th Anniversary of Earth Day Proclamation, stated, "We must ... seek solutions that embrace all sectors of society in preventing pollution and ecological damage before they occur." USEPA Administrator William Reilly also identified pollution prevention as the environmental goal of the 1990's: "We must start preventing pollution as the primary means of meeting our environmental objectives" (Shen, 1990).

This section describes pollution prevention and the shift in U.S. federal policies toward that approach. The potential advantages and disadvantages of pollution prevention will be analyzed.

Definition and Overview of U.S. Federal Policy Reform

It is important to note that pollution prevention is a broadly defined concept with no universally accepted definition. Some of the terms commonly used include: pollution prevention, toxic use reduction, waste minimization, clean technology, source reduction, and waste reduction. The Pollution Prevention Act of 1990 defined pollution prevention as any practice that:

1) reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and

2) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants (EPA, 1991).

Regardless of the term used, the justification for pollution prevention is that it yields greater environmental and economic benefits than the more traditional approaches of managing, treating, or disposing of waste.

Techniques. A broad range of techniques may be employed to reduce wastes. Some are as simple and inexpensive as placing a lid on a vat of solvent, while others require complex changes in product design or production. The following list of activities are the most common techniques for minimizing wastes:

- improved housekeeping/management techniques (that is, reducing inputs and byproducts)
- substitution of raw materials (that is, less toxic or non-toxic inputs)
- reformulation/redesign of products (that is, coatings, paints)
- equipment/technology alterations
- procedure/process changes

Each of these techniques is discussed in Chapter Five.

Scope of Approach. A brief definition of pollution prevention does not convey the full scope of the approach. Pollution prevention is a comprehensive systems approach to waste management. It incorporates production, as well as consumer behavior. It is a multi-media approach that addresses the environment as a unified whole; this avoids the potential transfer of pollutants from one medium to another.

Evaluating the environmental costs of alternative products over their entire life can also be a part of pollution prevention. Known commonly as "product life-cycle assessment", this type of analysis evaluates all stages of a product's life, from the mining of raw materials through production, consumption, and final disposal or recycling. For each stage in the cycle, material inputs, energy used, and wastes generated are identified and quantified. This comprehensive view reveals new opportunities for pollution prevention throughout the product life. It also allows regulators and managers to see where cross-media transfers or harmful emissions may occur, and make policy and production decisions that will have the least overall environmental impact.

Finally, pollution prevention calls for a new way of thinking about production and consumption. A successful program depends not simply on the application of appropriate source reduction, but on a new environmental ethic and commitment to quality. These traits are embodied in Total Quality Management (TQM). Based on a commitment to continuous improvement, TQM is a natural vehicle for pollution prevention.

In TQM, we have the tools and mentality for effective implementation of pollution prevention. TQM begins with accepting that we are never as good as we can be. In its simplest form, total quality is

continuous improvement based on data-based understanding of every process, whether it be the production line or a wastewater treatment plant (GEMI, 1991).

The U.S. firm AT&T has incorporated TQM as part of their environmental initiative, giving environmental goals importance comparable to that of product performance, reliability, and price. To justify such high priority, environmental projects must meet two requirements. First, the cost of waste management must be accounted for accurately to give environmental impacts a "real" value. Second, environmental expenses must be considered costs of the product and not taxes on the firm (Bretan, 1991).

U.S. Federal Policy Reform. In the 1980's, industry began to shift the focus of environmental management from pollution control to pollution prevention. New statutes and regulations provided some of the impetus for this change. The Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA), passed in 1984, requires industries to report their efforts to reduce the volume and toxicity of waste generated. Though these statutes primarily require command and control-based standards, they have served as an impetus for waste minimization programs and innovations in pollution prevention.

In October of 1990, Congress passed the Pollution Prevention Act requiring that pollution be reduced at the source whenever possible. If waste cannot be prevented, it must be handled in approved ways. In addition, the Act requires the EPA to promote source reduction. Some of these activities include:

- establishing a Source Reduction Clearinghouse to convey information to businesses
- providing outreach and training programs
- developing regulations and reporting requirements that encourage prevention
- coordinating source reduction activities with other federal and state agencies
- identifying regulatory barriers to source reduction and suggesting possible ways to overcome the barriers (EPA, 1991)

Advantages of Approach

Government. Federal, state, and local government spends considerable amounts on developing, monitoring, and enforcing policies, for example, regulations designed to ensure the safe and effective management of industrial wastes. Reducing the amount of wastes can reduce the costs of programs such as the Resource Conservation and Recovery Act (RCRA). In addition, funds spent on clean-up activities associated with disposal sites may also be reduced. In the long term, pollution prevention allows limited financial resources to be devoted to other government programs and services.

Industry. Industry should benefit substantially from implementing pollution prevention. The most significant gain is the reduction in production costs achieved by:

- decreasing treatment and disposal costs
- using different and potentially less expensive raw materials

- reducing, reusing or recovering production inputs, thereby decreasing raw materials costs
- reducing the cost of complying with pollution-related regulations
- reducing liability associated with waste treatment and disposal practices
- reducing staff time spent on spill cleanup, equipment maintenance, and sick-leave due to occupational exposures

In reducing production costs, firms can improve their competitive standing. As one DuPont executive stated:

> Waste reduction can also give us a leg up competitively. In the past, few companies factored the costs of waste disposal into their manufacturing processes. Today, an economical and environmentally acceptable plan for waste management may well make DuPont the low-cost producer—and hold the key to the success or failure of many of our businesses (OTA, 1986).

In developed countries, waste reduction initiatives have improved industry's public image. Environmentally conscious consumers may prefer products produced by environmentally sound techniques. This in turn, can raise profits. However, consumer preference may not be as successful in supporting pollution prevention in many developing countries; poverty, politics, and monopoly control can limit the power of environmentally conscious consumers.

In 1975, 3M established a pollution prevention program called Pollution Prevention Pays or 3P. By 1988, 3M had incorporated 3P into 2,444 projects resulting in the prevention of 122,000 tons of air pollution, 16,000 tons of water pollution and 400,000 tons of sludge and solid waste, as well as cost savings of over $480 million (Comella, 1990). Initially, the company made simple, low cost changes that were appropriate in the first stages of a pollution prevention program. Subsequently, even investments that seem high have yielded significant savings and pollution reductions. For example, a device that regulated temperatures during a paper coating and drying process eliminated start-up wastes of silver, paper, solvents and labor. This $16,000 investment provided annual savings of $533,200 and prevented the generation of 137 tons of solid waste and 53 tons of air pollution per year (Comella, 1990).

Society. The most obvious benefit of pollution prevention is a cleaner environment. In the long term, prevention techniques offer hope of protecting natural resources by easing the problems of acid rain, global warming and loss of wildlife species. With a cleaner environment, the public is less susceptible to the adverse health effects associated with the generation, treatment, and disposal of wastes.

As consumers, members of society can benefit from waste reduction. Reduced production costs may reduce product price. Product quality can improve as a result of waste reduction efforts. In addition, changes in production processes, such as using a lead-free paint, can result in safer products.

In the long term, pollution prevention contributes to improved efficiency within the production process. If more goods and services are produced per unit input, resources that are (or will be) scarce may be conserved for future generations.

Disadvantages of Approach

Government. Though less costly than pollution control, the administration of pollution prevention still requires considerable government resources. Identifying the potential for waste reduction and appropriate policies to achieve pollution prevention goals requires financial investment. Once in place, pollution prevention programs require government support for monitoring and enforcement. Also, many government agencies rely on the use of education and technology transfer to promote waste reduction. Programs for education, research, technology transfer, and technical assistance often need government support.

Industry. Although prevention measures offer industry many opportunities to reduce operating expenses, many of the more substantial savings cannot be achieved without initial cost. The modification of production processes, changes in product design, input substitutions, and investment in research and development all present a financial burden for industry.

Another disadvantage of pollution prevention is the risk and uncertainty associated with many prevention measures. To the extent that the long term cost savings of prevention techniques are difficult to quantify, the initial costs of altering operations may be hard to justify.

Society. Pollution prevention carries a risk of unemployment in some industrial sectors. If, for example, production changes lead to more capital-intensive processes or the production of specific goods is decreased or eliminated, the need for labor may fall.

CHAPTER THREE: IMPLEMENTING POLLUTION PREVENTION IN DEVELOPING COUNTRIES

Overview

The previous chapter described the shift in waste management from pollution control to pollution prevention. Under this new approach, society benefits from reduced environmental and health effects of pollution and industry benefits from lower operating costs. This chapter examines how USAID can help host countries implement pollution prevention, including the relevance to host countries of the U.S. experience, the conditions that support pollution prevention, and how USAID can help develop these conditions. The advantages and disadvantages of possible interventions will also be discussed.

How Developing Countries Can Benefit from the U.S. Experience

In the U.S., the understanding of pollution prevention has been growing for many years, but only recently have the environmental and economic benefits of prevention been identified and acknowledged. In developing countries, the level of development, political situation, and industrial structure are such that U.S. policies and technologies may not be appropriate. Potential donors must identify techniques that are suitable to the education level, technological expertise, and political atmosphere of the host country.

Benefits Suggested by the U.S. Experience

Cost. Developing countries may save money by developing a waste management system that emphasizes pollution prevention rather than control, but that has yet to be demonstrated in most USAID assisted countries. These systems, as discussed in Chapter Two, require monitoring and enforcement systems which can place considerable strain on a government's resources. In developing countries where there are numerous small-scale operations, it may be more difficult to monitor and enforce regulations.

Incentive schemes may help host country governments focus on preventing pollution in a more cost effective manner. Prevention measures combined with incentives, such as emission fees, may encourage firms to voluntarily reduce their consumption and subsequent waste.

Natural Resources. Many developing countries depend heavily on their natural resources, such as minerals, fisheries, and forests (Speth, 1990). Population growth and a movement toward materials- and energy-intensive industries increases this dependency, and risks widespread resource depletion. This means resource efficiency (that is, the amount of product that can be produced per unit of input) is essential to prevent resource depletion and allow sustainable economic growth.

The end-of-pipe approach to waste management offers no incentive to improve efficiency. Pollution prevention, on the other hand, calls for more efficient use of resources by streamlining production processes and reducing, reusing or recovering production inputs. This allows industry to decrease its demand for raw materials and help lessen the problem of resource scarcity.

Environment. Inefficient operations and poor maintenance account for 50 to 90 percent of pollution: pollution control technologies typically only remove a small percentage of this pollution (Kosmo, 1989). Reducing wastes at the source causes less stress on the environment than trying to manage, treat, or dispose of wastes. Source reduction can also help prevent the transfer of wastes from one environmental medium to another.

Time. U.S. environmental regulations and technologies have taken decades to develop and implement. The U.S., along with many other land-abundant developed countries, sustained economic growth for almost 100 years before the environmental consequences were understood. The first systematic efforts by government to promote sustainable forest and watershed management came 40 years after the beginning of the industrial revolution.

Today, many pre-industrial countries already face environmental crises that cannot wait 40 years for solutions (USAID, 1989). USAID can help host countries develop sustainable environmental strategies, such as appropriate pollution prevention programs, in a timely manner. The U.S. experience can help environmental officials design and implement programs with greater speed and efficiency than the U.S.

Access to Established Knowledge Base

Public and private sectors in the U.S. have developed a significant base of pollution prevention materials that could be very useful for USAID host countries. Some of these materials include:

- guidelines on carrying out waste reduction audits
- fact sheets on the chemical composition of waste materials
- epidemiological studies of the carcinogenic, reproductive and other health risks associated with hazardous wastes
- guidelines for siting and operating hazardous facilities
- information clearinghouses which provide bibliographies of pollution prevention materials, contacts, case studies, and listings of environmental technology vendors.

More examples of the pollution prevention literature and databases are provided in Chapter Six.

Acquiring Proven Environmental Technologies

The U.S. has been a leader in developing environmentally sound, resource-conserving technologies for many industries. While many of these technologies are designed specifically for U.S. conditions, there

are many low-cost, relatively simple options that would be effective in developing nations, such as improved housekeeping and management.

Even some capital-intensive technological options, such as power generators, are appropriate for developing countries, where they may be more cost effective than in the U.S. In the U.S., the construction of a new power facility may require the destruction or rebuilding of existing facilities at an enormous cost. In developing countries, however, power plants are often a new investment and the added cost of an advanced facility in comparison to other alternatives may not be significant. In reference to power facilities, *World Resources 1990-1991* states:

> For developing countries and for international development agencies, the best strategy appears to be to adopt or support the use of these more efficient and less-polluting technologies as new investments are made to build up a country's industrial base. By leapfrogging to newer technology, developing countries would avoid both a significant increment of additional pollution and the possible expense of future retrofits, while building a more efficient economy.

Capital intensive investments in developing countries, should occur only after simpler measures have been explored. It may be more cost effective to implement less capital intensive initiatives, particularly where labor is cheap. Chapter Five will explore this issue in further detail.

Factors Affecting the Potential for Pollution Prevention

Many factors influence the success of pollution prevention. Understanding the importance of each factor in a particular host country can increase the chances of success. This section highlights seven of the most significant factors:

- Environmental Awareness
- Technological Capabilities
- Policy Framework
- Enforcement Capabilities
- Data Collection/Analysis System
- Financial Resources
- Incentives

Environmental Awareness

Environmental awareness is an essential component of pollution prevention. In industry and agriculture, producers must understand the types and amounts of waste generated, as well as the environmental and human health results of releasing those wastes. This information is often lacking or incomplete. Even when the information is available, lack of environmental awareness and illiteracy contribute to needless environmental degradation. For example, the improper disposal of pesticides has the potential of

poisoning individuals or polluting ground water. This could be due to misinformed management or illiterate workers. With a better understanding of impacts, environmental producers may alter their practices, which may reduce the risk of environmental damage.

An informed public has been an important catalyst for prevention in the U.S. Increasing awareness on the threats to human health and the environment led to public pressure for protective action and right-to-know legislation. In some cases, consumer purchases and investments have favored clean producers, thus pressuring highly polluting industries to improve their operations to remain competitive.

In developing countries, this role of the public may not be as effective at changing industry behavior. Even when the necessary information is available, the general public may not have the purchasing power or the political clout to influence industry or government. Raising the awareness of managers and policy analysts may bring about greater improvements in environmental management.

Technological Capabilities

Technological capabilities can be divided into two components. First, members of industry must be familiar with pollution prevention options and the ways to obtain selected technologies, as well as their suitability. This may be accomplished through the publications and outreach efforts of environmental authorities, trade associations, universities, and research institutes. Materials should be issued to both small and large companies, in a format that is easy to understand.

The second component of technological capabilities involves the skills to operate and maintain the technologies. This requires a more active approach: training programs, workshops, and on-site instruction may be required. Donor agencies can provide some of this training. Efforts should be directed at "training the trainers," and the strengthening of local experience and knowledge.

USAID's existing programs can promote both components of technological capability. For example, programs aimed at private enterprise could include education on the economic and environmental benefits of pollution prevention. These same programs could extend conditional funding designed to promote prevention measures. Rural agricultural programs also could reduce non-point source pollution by encouraging more environmentally appropriate practices and pesticide application.

Policy Framework

Governmental policymakers have an important role in promoting pollution prevention. With an effective policy framework, adequate education, and suitable technology, pollution prevention can work for itself. Through incentives, firms find it in their economic interest to protect the environment. For example, regulations provide an incentive to reduce pollution by penalizing for noncompliance; economic incentives use open markets and competition to promote waste reduction.

Often industry is not held responsible for how its use of resources influences others. Without an effective policy framework, the full costs of resource use are not felt (that is, the social cost of environmental

pollution is not paid by the polluter). Polluting is often easier and cheaper than waste reduction or treatment. The only cost of waste disposal may be the price paid to a local waste hauler, who deposits the material on uncontrolled waste sites or into nearby swamps or streams. Consequently, industry has little incentive to reduce the quantity or toxicity of the waste it generates, and society bears the cost (World Bank, 1989).

Many policies in developing countries work against pollution prevention. Subsidies for water, energy, and other raw materials, for example, can encourage wasteful and environmentally harmful activities. Artificially low prices increase the use of these input materials and provide no incentive for their efficient use (Kosmo, 1989). In establishing a pollution prevention policy framework, removal of policy distortions are as important as the development of new legislation.

Enforcement Capabilities

Enforcement capabilities must complement policy development. An environmentally sound policy framework is not likely to be effective unless government has sufficient enforcement capabilities to insure compliance.

A credible enforcement system begins with policies that set achievable goals. Many developing countries have modeled their legislation on U.S. standards that may not be realistically enforceable under current economic or technological conditions. Adopted policies may prove inappropriate for cultural reasons, as well. For example, litigation is unpopular in many societies in Asia. Though environmental regulations may provide imprisonment or fines for noncompliance, courts are used rarely and penalties, if levied, are usually negotiable (Erocal, 1991). Under such circumstances, attempts to enforce policies only weakens the credibility of the legislative and enforcement systems.

An effective enforcement system also requires adequate expertise: that is, a sufficient number of professionals to conduct facility audits, measure emissions, and interpret environmental data. It is estimated that developing countries have less than 20 percent of the environmental staff required to meet these needs (Ludwig, 1990). With limited human resources and money, developing countries should focus on setting priorities for an enforcement program, so that programs can be phased in to suit capability.

Data Collection/Analysis System

A data collection and tracking system is an important part of a pollution prevention program. Environmental data enable governments to identify waste reduction opportunities and set priorities. Data on production processes, waste output, and the effectiveness of various technologies can highlight the most cost effective and appropriate methods for pollution prevention. Governments may maximize the use of limited resources by focusing attention on the most urgent concerns.

By collecting detailed data on production processes and wastes, regulatory authorities can determine whether a facility is complying with established legislation. If not, authorities can levy fines or, in

extreme cases, close plants. Conversely, if a facility has surpassed its wastes reduction goals, authorities may award or recognize these successes.

Data collection and analysis are necessary for regulators to test the effectiveness of pollution prevention programs and pinpoint successes and failures. These data also allow regulators to design better programs in the future.

Financial Resources

Waste reduction projects can involve changes in production processes, some of which can be expensive. Industry may resist investing in unfamiliar technology, in spite of likely long term benefits. Investments that yield short term benefits may be more attractive, but they can be environmentally destructive in the long term. USAID and other donors need to demonstrate to industry that many process changes will pay for themselves through reduced waste management and raw material costs.

In the first stages of a pollution prevention program, firms should invest in simple, low cost technologies. Later, significant investments with long term benefits are feasible when their financial resources and technical expertise allow. Firms should understand the economic benefits and costs of pollution prevention technology before investment and implementation.

Government programs to implement and enforce environmental policies and to provide pollution prevention training and outreach services also cost money. As in industry, environmental programs must compete with other programs for limited funding. In developing countries especially, the demand for government to provide food, jobs for their growing populations, accommodate rapid industrialization, and pay off international debts may outweigh concerns for environmental protection. As in the private sector, if the government invests in pollution prevention programs, simple, low cost options (such as, education and improved housekeeping techniques) should be pursued.

Pollution prevention initiatives may require significant funding from outside sources. Lending institutions and agencies such as USAID can encourage the voluntary pollution prevention through educating both private industry and government officials on the short and long term benefits of prevention initiatives.

Incentives

Firms need incentives to alter their production habits. Clean technologies, for example, can improve a firm's competitive advantage through decreased operating costs. Strict enforcement of environmental regulations and the threat of penalties, likewise, encourage waste reduction.

Individuals and organizations, however, have a strong tendency to maintain the status quo and there are occasions when these incentives alone may not convince a firm to alter its operations. Even when reduction techniques have been proven effective in reducing costs and improving product quality, firms may be reluctant to change.

Government incentive programs may provide the extra impetus needed for firms to implement pollution prevention. Financial incentives in the form of subsidies, low interest loans, and tax credits, for example, may be offered to firms that embark on a waste reduction program. Public recognition and awards for exceptional achievements in waste reduction are effective and educational incentives.

USAID's Role in Developing the Conditions Necessary for Pollution Prevention

Many of the techniques that have been used to achieve the Agency's environmental goals can be used to implement pollution prevention: policy dialogue, technology transfer, and institution building. Together, these techniques can cover all sectors of host country economies and develop supportive framework for pollution prevention.

As a means to promote pollution prevention, these techniques can be effective if used correctly to address the fundamental causes of environmental degradation. These are not simply reactive measures to address environmental issues piecemeal, but measures to address institutional sources of environmental problems. These techniques also offer an approach that can be replicated: although recommendations will vary according to the conditions of a particular country, the general approach and options for preventing pollution can be applied to the wide range of USAID assisted countries.

This section describes the techniques of policy dialogue, technology transfer, and institution building, and identifies some of the constraints facing USAID in using these techniques to encourage pollution prevention.

Intervention Techniques

Policy Dialogue. USAID began conducting policy dialogues with recipient governments as early as the 1970's. The process involves negotiations between USAID field staff and host country policy makers, technicians, and often members of industry and nongovernmental interest groups. The purpose of these dialogues is to encourage the formation of policy frameworks that support sustainable economic growth (Talbot, 1985).

By using existing ties with host country governments and drawing from the U.S. experience in environmental policy development, USAID can help host countries establish a policy framework to support pollution prevention. Specifically, the goals of dialogue will be:

- to advocate removal of distortions within the current policy structure which may work against prevention efforts
- to establish an environmentally sound system of regulations and incentives to promote pollution prevention
- to identify enforcement and data needs for successful program implementation

The first targets for removal of economic and political barriers to pollution prevention should be USAID's centrally funded programs. This way, USAID can coordinate efforts with other donors and prevent counterproductive or redundant activities. Policy dialogue can increase environmental awareness in the private and public sector and can improve both centrally funded and regionally funded programs. Chapter Four discusses policy dialogue and how it can promote specific tools for pollution prevention.

Technology Transfer. Technology transfer is the means by which new technologies, including knowledge, procedures, products, and skills, are made available to the potential users of that information. It includes both a "hard" and "soft" side. The hard side entails identifying and exporting appropriate technologies. The soft side refers to the changes in personnel attitudes, public and corporate policies, and institutional capabilities that are necessary to support new technologies.

The goal of technology transfer for pollution prevention is to provide processes which use materials efficiently, generate only benign releases, and increase productivity. The steps to meet this goal range from simple, low-cost housekeeping measures to highly sophisticated, costly equipment alterations. For all options, training and technical assistance services must be provided.

The transfer of technology, combined with education, will improve technological capabilities. Having the technology in place will familiarize users with the operation and maintenance requirements and economic benefits. Technology can improve developing country data collection and analysis capabilities. Computers and software packages can compile information on industrial processes and pollution discharges, and help government officials and industry with developing pollution prevention strategies.

The "hard" side of technology transfer may be best addressed at first through centrally funded programs. The "soft" side of technology transfer can be addressed at all program levels. Chapter Five discusses technology transfer in greater detail.

Institution Building. USAID expanded its "institution building" approach to development when many of the traditional growth-maximization and industrialization approaches were under scrutiny. The traditional approaches promoted rapid growth through capital-intensive industries while ignoring the many obstacles and bottlenecks to growth that are unique to developing countries. Consequently, assistance programs had little positive effect on GNP or poverty (Rondinelli, 1987).

The goal of institution building is to address the economic, social, and political obstacles to growth and to create an environment more conducive to development. Through training programs and technical assistance, USAID insures that host countries have the skills needed to carry out program objectives long after program funding has been stopped.

Many host countries lack up-to-date knowledge of the causes or extent of environmental damage, let alone the options available to prevent that damage. This means institution building is essential to pollution prevention. Raising the awareness of local people can build a local constituency with a long-term interest in wise management of resources. Capacity building is also essential in the government and industrial sectors and allows other initiatives in policy dialogue and technology transfer to be successful.

Institution building can help foster the factors identified earlier that affect pollution prevention programs. Developing county institutions themselves must ultimately provide enforcement, data collection and analysis, and incentives for society to implement pollution programs.

Institution building can occur within both centrally and regionally funded programs. Regional and local institutions have a significant role in spreading information on the economic benefits of pollution prevention, and can develop educational programs and workshops specific to local practices. A general institutional framework specific to the country can be developed within a central program. Later, regional programs can implement institutions that address area-specific problems. Chapter Six discusses institution building in detail.

Constraints on USAID

Administrative and Budget Restrictions. Coordinating activities between USAID Washington and the overseas missions can create logistical difficulties. Budget constraints can also limit the size and scope of projects, particularly long-term projects such as pollution prevention, which are vital for effective environmental management (CHE, 1988).

Environmental Capacity. One of the fundamental requirements for a successful pollution prevention program is adequate environmental capacity: that is, a sufficient number of well-trained environmental professionals to cover Agency needs for policy guidance, oversight, and technical support. This is an area where USAID has been criticized for its deficiencies. For example, even though USAID is required to perform Environmental Assessments (EAs), it lacks staff to interpret the analyses. This shortage can delay the review process and encourage project leaders to seek alternate routes for project approval (CHE, 1988). If a pollution prevention program is to be attempted, there must be adequate technical expertise to implement and maintain the program.

Lack of Data. Environmental data are usually lacking or unreliable in developing countries. Without accurate data on environmental and conditions trends, it is difficult to assess potential program impacts, evaluate program successes and failures, and design more realistic programs for the future. Experienced USAID technical staff who can speculate in the face of uncertainty may relieve some of the limitations associated with inadequate data. However, the Agency needs these staff in adequate numbers.

Diversity of Host Countries. Another restriction facing USAID is the differing needs and levels of development of the countries it assists. With programs in over 80 host countries, USAID encounters a range of disparate cultural, environmental, political, and economic conditions. There is no one protocol that can be duplicated. Rather, a strategy must be tailored to the conditions and needs of each host country.

Limited Control. A significant portion of USAID's development activities are conducted jointly with other donors and financial institutions. USAID can make use of other donors' strengths, increase funding, and encourage mutually consistent goals. However, it is in a supportive role and often must compromise to ensure compliance with its environmental guidelines.

CHAPTER FOUR:
USING POLICY DIALOGUE TO PROMOTE POLLUTION PREVENTION IN USAID PROGRAMS

Overview

Policy dialogue involves communications between USAID field staff and host country government officials to encourage the development of environmentally sound policy. Through policy dialogue, USAID staff may encourage the development of new policies, the removal of policy distortions, and the enhancement of enforcement and data collection systems. This chapter provides examples of the policies USAID may advocate to meet the goal of waste reduction. It defines and illustrates various regulatory options and environmental incentives. Finally, the chapter analyzes the suitability of these options for developing countries in terms of their economic efficiency, feasibility, and effectiveness.

Regulatory Instruments

Direct "command and control" regulations have been the primary waste management tool for governments worldwide. Though this approach has significant limitations, regulations can help implement pollution prevention initiatives. Regulations can reduce the quantity of specific wastes released, and establish a framework for collecting industrial and environmental data. Where market forces do not provide sufficient economic incentives, regulations compel firms to reduce wastes. The most commonly employed regulatory instruments, that have possibilities for pollution prevention purposes include:

- Standards
- Permits and Licenses
- Land and Water Use Controls
- Bans on Certain Inputs and Outputs

Standards

Standards are the most common and direct policy instruments used to reach target levels of environmental quality. They define levels of environmental quality and permissible amounts or concentrations of pollutants released to air, water, or land. Failure to comply with standards usually results in a fine or, in some cases, prosecution. Several of the most common types of standards are defined below:

> *Ambient Environmental Quality Standards*. Ambient standards define a limit for pollution discharges to air or water. Compliance with these standards is usually achieved by using control technology to limit discharges to a particular media. This type of standard is frequently used to limit environmental damage in urban or industrial areas.

Effluent or Emission Standards. Effluent or emission standards define a maximum amount or concentration of wastes released from a particular source. They may apply to an entire industry, a particular plant, or to specific points of discharge from a plant. These types of standards are generally designed in conjunction with ambient level standards.

Product and Process Standards. Product and process standards define a maximum level of pollution that can be released to air, water, or land. They can be used to prohibit the use of highly toxic substances as inputs to production and they may require the use of best available technology.

Product and process standards may be the most useful application for pollution prevention programs. While ambient and emission standards are typical of end-of-pipe approaches, product and process standards can prevent pollution by changing the process inputs.

Policy dialogue to introduce the use of standards would involve government environmental officials. It would also be helpful to include industry representatives to define realistic standards and achievable goals. Industry representatives from both the U.S. and the host country can provide valuable insight on options for toxics use reduction and effective waste reduction technologies. U.S. industry can provide information on proven technologies and techniques, while developing country industry representatives can advise on country-specific processes and technologies.

Permits and Licenses

Permits and licenses are often associated with specific air or water quality standards. A facility that applies for a permit usually must meet certain requirements, such as compliance with a code of practice, or installation of pollution treatment equipment. Although permits require regular monitoring by the regulator, they also make a facility's pollution control responsibilities clear.

Through policy dialogue, USAID could encourage governments to include pollution prevention measures in permit and license requirements. If these measures are required before construction of a facility starts, industry will be forced to consider the issue; developing countries may reduce the potential for environmental degradation at the source.

Land and Water Use Controls

Land and water use controls are tools used primarily by local government. Examples include urban and industrial zoning, and restricting use of natural water resources. Such controls allow regulators to protect specific fragile environments and control the pattern of urban development. However, land use controls are often subject to local economic and political pressures that may override environmental goals. A thorough understanding is needed of how land and water rights are structured and who is accountable for enforcing these rights.

Pollution prevention techniques can help industry or public works comply with land and water use restrictions. For example, water supply is a major issue in most developing countries. Pollution prevention techniques of water recycling and conservation are alternatives to expanding water use. Policy dialogue on land and water use may involve government at the national level. Local officials may be educated through policy dialogue on the economic and human welfare benefits of requiring technologies that reduce water used in the production process as well as wastewater discharges.

Bans on Certain Inputs or Outputs

Bans are the strictest form of regulation and the most direct way to reduce the specific wastes that are damaging to the environment. Bans on asbestos and PCBs, for example, have significantly reduced environmental hazards.

In spite of the benefits of this approach, it has several drawbacks. In particular, it is difficult to prove that a specific substance poses such a threat to health or the environment that an outright ban is called for. In addition, there is the possibility that a substitute material may pose an even greater threat than the material it replaces. Finally, society may decide that the economic benefit of certain materials outweighs the environmental costs.

To justify policies that ban specific materials through policy dialogue, there needs to be strong evidence that the material causes significant harm to health or the environment. Developing countries are not likely to implement restrictions unless evidence is conclusive, since they face strong pressures to attract new industry or businesses. Unless a convincing argument for a ban is presented, this mechanism may not be as successful as other regulations and incentives for encouraging pollution prevention.

Economic Incentives

Recently, economic incentives have been employed more widely to improve environmental quality. Unlike regulations that command specific results, economic incentives work through markets and prices to encourage desired behaviors. This allows facilities flexibility and encourages innovation in finding the most efficient and cost-effective ways to reduce wastes. Economic incentives to improve environmental quality include:

- pollution charges
- pollution permits
- subsidies
- deposit-refund schemes

Pollution Charges

Pollution charges are, in effect, a price paid for conducting or supporting an operation that creates environmental harm. Examples include effluent or emission charges, user charges, product charges and

administrative charges. The effectiveness of a charge system in altering behavior depends on government's ability to establish an appropriate rate structure and collection system.

One of the benefits of a pollution charge system is that the cost of reducing pollution is generally lower than the cost of end-of-pipe solutions: firms select the prevention technique that is most appropriate and cost-efficient for their operation. Pollution charges also provide a source of revenue that government may use for environmental programs. However, these advantages may offset each other. If these charges are successful at reducing pollution, revenues will be lower.

A disadvantage of the charge system is the administration, monitoring, and enforcement involved. Though less demanding than regulatory instruments, pollution charges still require enforcement to assure compliance. Government also must determine what level of fines will be high enough to change behavior, yet low enough to prevent job loss and negative political reactions.

In the context of policy dialogue, pollution charges need to be promoted through appropriate environmental agencies and government officials. However, dialogue with industry representatives would help organizations understand the effectiveness of pollution charges for promoting pollution prevention instead of end-of-pipe controls.

Marketable Pollution Permits

Under a system of marketable pollution permits, facilities can buy and sell the "rights" to conduct operations that create pollution. Under this system, government determines a maximum acceptable level of pollution for a given region. A fixed number of permits are issued that will keep the pollutant level below the maximum threshold. Permits can be traded on the market, at a price that reflects the cost of treatment and the feasibility of prevention measures.

One further extension of market factors into the permit system goes beyond what is usually meant by a marketable permit system. The government may charge for permits, and rely on price diferentials to reduce pollution by region. In crowded urban areas or environmentally sensitive areas, for example, government may set a high price for permits, while in other areas, permits may be free to encourage firms in more polluted areas to move.

Policy dialogue to promote this option requires the involvement of government officials, environmental scientists, and policy analysts. Scientific data would be needed to set an acceptable level of releases to the environment in each region. Policy analysts can assess how effective marketable permits will be at reducing pollution.

Encouraging pollution prevention through marketable permits depends on educating industry, and the price of both pollution prevention technologies and the permits themselves. Given a fixed number of permits the pollution threshold should not be exceeded. However, there is little incentive for industry to make further improvements once the approved pollution level has been met.

Subsidies

Subsidies, in the form of grants, low interest loans, or tax incentives, can be used to promote pollution prevention. A research grant, for example, can encourage the development of new production techniques that result in waste reduction. Direct payments or low-interest loans may help firms to acquire new environmental technologies or modify existing equipment. Tax incentives, such as tax credits or accelerated depreciation for investment in equipment, can reward an organization that implements pollution prevention measures.

If the government is willing to promote pollution prevention through subsidies, policy dialogues should take place with the appropriate government agency. However, various subsidies can be introduced through policy dialogue with the private sector. Private organizations such as banks, may be more receptive to new ideas with potential economic benefits. If banks are shown the economic benefits of pollution prevention, they may offer low interest loans that require the implementation of pollution prevention programs. USAID should determine who will provide the subsidies in question and design the policy dialogues accordingly.

Deposit-Refund Schemes

A deposit-refund system adds a surcharge to the price of potentially polluting products. The consumer pays the surcharge when the product is purchased. When the product is returned to a designated collection site, the surcharge is refunded. This approach is most effective when applied to products that are durable and reusable (such as beverage containers) or those that pose significant threats to the environment (such as automobile batteries).

A deposit-refund scheme may also be applied to polluting processes. With this approach, a firm pays a deposit in relation to the wastes it produces. When proof is given that waste reduction techniques have been employed, the deposit is refunded.

The advantages of a deposit-refund system is that it reduces waste disposal and discourages littering while conserving energy and raw materials. The incentive for compliance is built into the price of the product or process. The disadvantage of this approach is the cost of establishing and maintaining collection centers. Where a large refund is involved, counterfeiting and theft may arise.

Under this option, policy dialogue should include both the private and public sector. However, in many countries, organization and maintenance may be difficult if there is a history of corruption or fraud. Policy dialogue with government officials should address these issues early. The effectiveness of this option for encouraging pollution prevention is limited, since deposit refund systems focus on recycling instead of source reduction.

Evaluation of Policy Options

The regulations and incentives discussed above are examples of policies USAID may choose to advocate in dialogues with host country governments, the private sector, and local NGOs. In determining the suitability of these policy options for developing countries, it is useful to assess them according to economic efficiency (can we afford it?), feasibility (can we carry it out?), and effectiveness (will it really work?). We provide this discussion below with a summary of our evaluation provided in Table 2.

TABLE 2. COMPARISON OF SELECTED POLICY OPTIONS

	Evaluative Criteria		
Policy Option	**Efficiency**	**Feasibility**	**Effectiveness**
Regulatory Instruments			
Standards	Low	Low	Medium to High
Permits and Licenses	Low	Low	Medium
Land and Water Use Controls	Low to Medium	Medium	Medium
Bans on Certain Inputs and Outputs	Low to Medium	Medium	Medium to High
Economic Incentives			
Pollution Charges	High	Medium	High
Pollution Permits	High	Medium	High
Subsidies	Low	High	Medium
Deposit-Refund Schemes	Medium	Medium	High

Economic Efficiency

With limited financial resources for environmental protection, developing nations must weigh various policy options for their economic efficiency: that is, which options achieve the desired goal at the least cost? Here, we will discuss the costs borne by government and industry under the two main policy options.

Government. From government's perspective, most regulatory schemes are less efficient economically. Standards, for example, require substantial start-up and enforcement costs. Bans and land use controls are less costly to start, but costly to administer.

Economic instruments are usually more cost-effective than regulations. Incentives that use the market ensure it is in the economic self-interest of the firm to reduce wastes. So, firms are motivated to 'police' themselves and government is relieved of some enforcement costs.

Both incentives and regulations have the potential of raising revenues. Charges and permit schemes, for example, can raise money that the government can then use to pay for other environmental programs. In contrast, subsidies are a net drain on government funds and also move the burden of clean-up costs from the polluter to the public. Policy dialogue with government officials should address all potential economic benefits and costs before regulations or incentives are selected.

Private Sector. Regulations generally require industry to make processing changes or buy control devices that can be costly. The regulations are usually the same for all facilities regardless of size or circumstances, and may overburden small operators.

Frequently, economic incentives are more appealing to industry. Although firms may still face increased costs, they can select the most cost-effective technique. Policy dialogue should include industry representatives if the proposed mechanism will lead to significant costs or benefits.

Policy dialogues should relate to the local economy, local lifestyle, and the national level of development. Area-specific cultural or economic barriers may be important. For example, specific agricultural techniques, such as monocropping or extensive pesticide use may be promoted or subsidized in a particular area. It may then be difficult to promote pollution prevention simply through education or new policies on intercropping or agroforestry. Policy dialogue with the government, multinationals, and local officials and entrepreneurs, can be effective at identifying and removing existing or potential barriers.

Feasibility

Feasibility—the relative ease of introducing and enforcing different policy choices—is another important standard in selecting the best pollution prevention strategy for USAID host countries.

Most regulatory approaches place the burden for both implementation and enforcement on the regulator. Regulatory authorities must set maximum pollutant levels and other environmental goals. For developing countries this may be difficult due to limited data and technology. Once a standard has been set, the regulatory authority must collect data and perform site inspections to confirm the types and quantities of waste produced. This requires significant financial and human resources. Some regulations, such as bans and land use controls, may be easier to implement, but require continual monitoring and enforcement.

Once in place, incentive systems are generally easier to administer. However, their introduction requires data collection and analysis since creating incentives that cause the desired market response can be very complex. Enforcement needs are reduced, since it is economically beneficial for the polluter to protect the environment.

Certain incentive programs present implementation obstacles. With pollution charges, for example, it is difficult to set fines that are high enough to encourage changed practices yet low enough to allow growth. So, the fine level may have to be adjusted over time to produce the desired effect. As with regulatory standards, a pollution permit scheme presents government with the problem of modeling the relationship between emissions and overall environmental quality.

Subsidies may be the most attractive option in terms of administrative requirements. The most significant implementation requirement is to provide money. Administration requirements consist of occasional monitoring to ensure that monies are being used for intended purposes.

Effectiveness

Ultimately, the key standard on which environmental policy must be evaluated is effectiveness (that is, ability to improve environmental quality).

Given an adequate enforcement system, regulation may be the most effective way to reduce specific wastes. If the penalty is severe enough, firms releasing wastes will take the steps necessary to comply. However, standards do not promote continuing reductions of emissions. For all standards, an "allowable" level of emissions or ambient environmental quality level must be defined as part of the policy objective. Firms have no incentive to improve beyond the compliance level and environmental quality will remain stable at best.

Unlike regulations or standards, pollution charges can continually improve waste reduction. Given an adequate enforcement system, charging facilities a price per unit of pollution places firms under constant pressure to do better. Charges can only be effective if the fine is high enough to deter violations. If the fine is too low, firms may find it economically advantageous to discharge wastes and pay the fee.

As mentioned above, one feature of the marketable permit system is its potential to reduce regional pollution. This is done by setting appropriate price differentials. In overcrowded urban areas, for example, government may set a high price for permits, while in far less developed or less fertile 2areas, government may distribute permits free, thus encouraging firms in more polluted areas to move.

Policy dialogue is an essential part of assessing the effectiveness of various policy options. Industrial managers, technicians, and government and local officials may have insights on how technical and political barriers would influence policy. USAID can identify and address these barriers more effectively through policy dialogue, at a variety of administrative and political levels.

The following chapter addresses options for pollution prevention technology and issues associated with technology transfer. Policy dialogue can help address these issues and design strategies for removing economic, political, and technological barriers. USAID can help facilitate successful policy dialogue by including governmental officials, environmental scientists and technicians, and industrial representatives from both developed and developing countries.

CHAPTER FIVE:
TRANSFERRING TECHNOLOGY TO PROMOTE PREVENTION IN USAID PROGRAMS

Overview

Technology transfer refers to the ways new technologies become available to the potential users. It includes a "hard" side: the identifying and exporting appropriate technologies. It also includes a "soft" side of changing personnel attitudes, public and corporate policies, and institutional capabilities to support new technologies. Both sides should be addressed through policy dialogue before approval or introduction of new technology.

This chapter discusses the hard side: the technological tools of pollution prevention. The soft side of technology transfer can be addressed through policy dialogue and institution building, as discussed in the following chapter. Basic waste minimization and recycling techniques are described and illustrated with the suitability of specific technologies are evaluated by cost, complexity, and environmental effectiveness. Finally, some potential implementation issues associated with technology transfer are discussed.

Waste Reduction and Recycling Techniques

Techniques that reduce the amount or toxicity of industrial wastes can be grouped into three classes: Class One sets up a framework that encourages waste reduction. Class Two are the traditional techniques for waste reduction; and Class Three includes additional reduction techniques under a broader definition of pollution prevention and may be important options for developing countries.

Class One

- Pollution Detection & Monitoring
- Waste Reduction Audit

Class Two

- Improved Housekeeping/Management
- Substitution of Raw Materials
- Reformulation/Redesign of Products
- Equipment/Technology Alterations
- Procedure Modifications

Class Three

- Materials Reclamation
- Off-site Waste Recycling

Class One

Pollution Detection and Monitoring Devices. Pollution detection is an essential first step in planning any type of pollution prevention program. It identifies where what types of wastes are generated. Without this data, government cannot design effective policies and firms cannot adopt appropriate reduction techniques. Moreover, pollution detection techniques provide a basis for measuring the effectiveness of waste reduction efforts. The following are examples of pollution detection and monitoring devices:

Remote Sensing. Remote sensing involves satellite or aircraft detection of regional environmental changes resulting from pollution. Changes can be identified with imaging technologies that use visual, infrared and microwave radiations. Images provide data on soil and water temperature changes resulting from contamination; help determine the reasons for agricultural failures; and provide an early warning system for potentially disastrous environmental threats.

Biological Sensors. Biological sensors involve the use of highly sensitive organisms to detect the presence of certain pollutants. Organisms may be used for testing at a particular site or under laboratory conditions.

Other Sensors. Other sensors, such as gas and liquid detection sensors, have a wider range of application. They vary in type from hand-held units to components of a large production line. Most, however, are fairly simple to use and do not require expenditures.

Many of these may be too sophisticated or expensive for developing countries. In addition, setting up complex monitoring devices at plants may not be the most cost effective option for either the firm or the donor agency. Analyzing the waste stream is an important part of long term pollution prevention programs. However, in the early stages, it would be more useful to improve management and working practices, and introduce very basic waste sampling, analysis, and quality assurance.

Waste Reduction Audits. Waste reduction audits are a type of pollution detection carried out at the plant level. They track the physical flow of raw materials through the production process. An audit should be a company's first step in planning a waste reduction program. Simplified, the audit process involves:

1) Identification of the quantities and types of wastes being generated.
2) Identification of the processes associated with each type of waste generated.
3) Analysis and selection of technically and economically feasible waste reduction techniques.

4) Economic comparison of waste reduction alternatives.
5) Evaluation of the progress and success of waste reduction measures (OTA, 1986).

These procedures allow firms to set priorities and estimate the savings from pollution prevention efforts.

Class Two

Improved Housekeeping and Management Techniques. Improved housekeeping and management techniques include procedural, administrative, and institutional steps that can reduce waste and improve efficiency. Employee training, incentives, inventory control, improvements in handling materials, sorting of wastes, and preventive maintenance are all examples of good management techniques. Many of these practices cost very little, and offer high returns on investment.

By managing the inventory and purchasing only what is needed, disposal of unused raw materials may be minimized. Sorting wastes may allow for more recycling and reuse, and may reduce total hazardous waste by separating non-hazardous from hazardous waste. Using shovels and brooms to instead of washing areas with water can reduce excess wastewater (Katin, 1991). Many of these measures can be introduced through education, via policy dialogue and institution building. Improved housekeeping and management may be the most practical option for most developing countries. For those countries that may consider long term, more costly pollution prevention programs, it is a good place to start.

Substitution of Raw Materials. The substitution of raw materials can be a very effective option for pollution prevention. The replacement of hazardous chemicals can have a direct and significant impact on reducing environmental hazards. Materials substitution efforts can be costly, so targeting the largest single material is often the most economical approach. Many hazardous substances can be replaced with a less toxic material. For example, trichloroethylene (TCE) can be replaced with 1,1,1 trichloroethane (TCE): it is less stable and more corrosive, but it is less toxic to humans and is not one of the volatile organic compound (VOC) contributors to ozone pollution (Katin, 1991). Detergents such as alkaline salts, surfactants, and emulsions may be able to replace toxic industrial solvents. USAID can promote substitution through policy dialogue and technology transfer, and can help design processes that use fewer hazardous substances.

Reformulation/Redesign of Products. A longer term and more costly approach to waste reduction involves product reformulation or redesign. If a suitable replacement for an original product exists, this may require only minimal expense. For example, using concrete pilings or recycled plastic pilings may help eliminate the waste associated with creosote-treated pilings. If product substitutes are costly or not readily available, industrial managers may be able to modify the existing product. Efforts to change product design should focus on reducing their toxicity and persistence, as well as improving their compatibility with recycling and treatment technologies (Berglund, 1991).

Product design should be part of any long term pollution prevention program. This approach to pollution prevention can involve simple changes such as reducing wasteful paints or coatings. However, extensive product redesign can require significant expense, and subsequently, hard technology transfer.

Equipment/Technology Alterations. Equipment modification is one of the more complex options for waste reduction. Still, simple measures can be pursued by developing countries, such as installing appropriately sized containers and lids, or containment devices for volatile chemicals. USAID can help ensure that technology transfer initially facilitates the use of simple and relatively inexpensive equipment that is compatible with the production processes.

Process Modifications. Process modifications range from simple, low cost changes to complete technology replacements. For example, a relatively inexpensive option would be to increase the drain-time between hoisting a part from an immersion tank and moving it to the next step. Other options may reduce harmful byproducts and energy use, but at a much higher cost.

USAID should initially focus their efforts on promoting simple modifications, such as regulating temperatures, that require minimal technology transfer.

Class Three

Materials Reclamation. Materials reclamation involves the recovery of valuable material from waste. Most often the recovery process occurs at the production facility where materials can be used again. Examples include the re-use of solvents for equipment cleaning, the re-use of collected pesticide dusts at pesticide formulators, the recovery of chlorine from the pyrolysis of chlorinated waste, and the re-use of ferric chloride wastes from titanium dioxide manufacturing as a wastewater conditioner in water treatment (World Bank, 1989).

This approach to waste management reduces the costs of waste disposal and raw material. However, before introducing complex reclamation initiatives, simple procedures should be improved, such as waste separation. These simple steps can improve materials reclamation in the short term and show the value of materials reclamation.

Off-site Waste Recycling. Many firms do not have the amounts of waste to justify an on-site materials reclamation program. For them off-site recycling is an effective way to reduce wastes. Valuable materials can be recovered from the waste, and may be used as a substitute for new materials.

The construction of a central recycling facility is expensive and may not make sense unless there are enough potential customers. This issue should be raised during policy dialogue to determine the need for a recycling facility and its potential effectiveness, given the nature of the wastes. A central facility should be considered only after individual facilities accept and implement on-site pollution prevention programs.

Evaluation of Waste Reduction and Recycling Techniques

The waste reduction techniques discussed above are effective in the U.S. and other developed countries in reducing the amount of waste requiring treatment or disposal. Before choosing which techniques

would be best for developing countries, it is useful to rate alternatives according to their cost, technical complexity, and effectiveness. Table 5-1 summarizes this discussion.

Cost

The costs of obtaining and operating new technologies is a major consideration for developing countries. This section compares the costs of the technologies discussed in this chapter. Of course, the cost for any procedure will vary, depending on the wastes involved, their quantity and toxicity, and the abatement level desired. Also, the costs should be weighed against the costs of not protecting the environment.

Cost-benefit analysis may help estimate the value of pollution prevention, but it may also be short-sighted. Traditionally, cost-benefit analysis assumes that a dollar of benefits today is worth more than a dollar of benefits tomorrow. Analysts use a "discount rate" to adjust for this relationship. Thus, one dollar of water quality benefits five years from now is worth less than one dollar of water quality benefits today. Scarce environmental resources, however, may in fact be worth the same or more in the future than they are today because of growing pressures from environmental degradation. Cost-benefit analysist should cousider using zero or negative discount rates to control for the potential degradation of extremely scarce resources.

Some of the options suggested in this chapter may be easier to justify if their cost is compared to the cost of environmental degradation if there were no pollution prevention measures. Analysts should consider

TABLE 5-1. COMPARISON OF SELECTED WASTE REDUCTION TECHNOLOGIES

Prevention Technique	Cost	Complexity	Effectiveness
Class One			
Pollution Detection & Monitoring	Low to High	Low to High	High
Waste Reduction Audit	Low	Low	High
Class Two			
Improved Management Techniques	Low	Low	High
Substitution of Raw Materials	Low to High	Low	High
Product Redesign/Reformulation	High	High	Medium
Equipment/Technology Alterations	High	High	Medium
Procedure Modifications	Low to High	Low to High	Medium
Class Three			
Materials Reclamation	Payback	Medium	High
Off-site Waste Recycling	Payback	Medium	High

the costs to society of reduced agricultural production, water quality, and other specific environmental resources that benefit a developing nation and its people.

Often benefits and costs to society at large are difficult to measure. They may not provide sufficient reason for a facility to change its technology or procedures. It may be more effective to analyze the direct costs and savings to the facility of the proposed changes. For example, a Total Cost Assessment (TCA) is a complete analysis of internal costs and savings (Freeman et al., 1992). The complexity of this analysis can be modified to suit the needs and the expertise of the facility. There are a variety of other assessment techniques that can assist host countries.

Class One. The pollution detection devices discussed above are invaluable techniques for planning a pollution prevention program. Some may be affordable for developing countries. Remote sensing involves high costs, which may be prohibitive to most developing country governments and industries.

Facilities can benefit a great deal from a basic waste reduction audit, and donors such as USAID can help initiate and conduct facility audits. For example, facility managers and expatriot experts could conduct an audit in a month. A facility inspection and brief technical write-ups would identify most problem areas and potential solutions. This option allows the audit team to understand facility needs and suggest effective pollution prevention strategies within a reasonable time frame.

Class Two. There is a broad range of costs associated with the traditional prevention techniques. The least expensive options, such as housekeeping changes, improve the operation of a plant. Management training can be costly, but is an essential part of improving operations. Procedure modifications and substitution of raw materials are affordable. However, most options involving product or technology alterations are costly and may not be suitable for developing countries. These options should be considered only after simple, low cost options with high returns on investment have been implemented.

Class Three. Waste recycling and materials reclamation can be a cost effective way to managing wastes. For certain materials, recycling may even be more appropriate for developing countries than for industrialized countries because of the scarcity and high cost of those materials (Evans, 1991). Start-up costs for setting up recycling facilities can be high. However, money saved by using recycled materials can pack back start-up costs in a relatively short period.

Technical Complexity

In the past, the U.S. has been criticized for exporting complex technologies to developing countries where they could not be used effectively (Elkington, 1989). Clearly, identifying prevention approaches that are compatible with the technical capacity of host countries is essential. Through education and simple, low cost changes, USAID may gain a sense for the potential of more complex technologies and a facility's (or nation's) ability to accept, implement, and maintain a long term pollution prevention program.

Introducing complex, high cost technology in the early stages of a program may discourage firms that cannot accommodate the technology, have not accepted the concept of pollution prevention, or do not

fully understand the potential benefits. Lost cost, low maintenance technologies that are compatible with existing processes are more likely to be successful in the short term. These successes encourage further involvement with (and enthusiasm for) long term pollution prevention programs.

Class One. Of the pollution detection systems, waste audits and certain gas and liquid detection sensors are simplest. Biological sensors entail fairly simple procedures, but the conditions for accurate testing are difficult to establish. Remote sensing requires more technical know-how and may not be a viable option for developing countries.

Class Two. The technical complexity of pollution prevention techniques generally rises with their cost. Therefore, developing countries can take the first steps in pollution prevention, such as good housekeeping and waste reduction audits, at relatively low cost. Operational changes are the least demanding, followed by equipment and process changes (that is, materials substitution). Due to the research and development involved, product and technology alteration are the most complex options.

Class Three. The complexity of recycling technologies depends on the purity of materials entering and leaving the system. Recycling measures can be as simple as adding basins to catch spills and recover raw materials suitable for re-use. Thus, in the case of relatively pure solid or liquid wastes (such as offcuts and spillages in a processing plant), the technology is simple. However, wastes such as metals, plastics, and petrochemicals require more complex recycling processes, and should be initiated only after preliminary, low cost measures have been put in place.

Effectiveness

An essential standard for judging technological choices is their effectiveness in reducing waste. Most of the techniques described here have been effective in the U.S., but will they work in developing countries?

If financial and technical constraints are overcome, many of the options discussed above may work in developing countries. However, there are additional barriers that could limit their success.

The waste streams in developing nations differ greatly from those of the U.S. The U.S. economy is based on manufactured goods, whereas developing economies are based on primary products. Like most developing countries, the U.S. has a strong agricultural base, but the crops and production technologies often differ. In developing country industry and agriculture, certain measures, such as technologies for recycling complex materials, may not be appropriate. However, waste segregation or crop rotation may be extremely effective if implemented and maintained correctly.

In addition, the climate of most developing nations differs greatly from that of the U.S. High temperatures, humidity, and rainfall can influence the effectiveness of pollution prevention initiatives such as erosion control or recycling technologies. Technologies that perform well in the temperate climate of the U.S. may be inappropriate for developing country conditions. If the U.S. is to provide effective

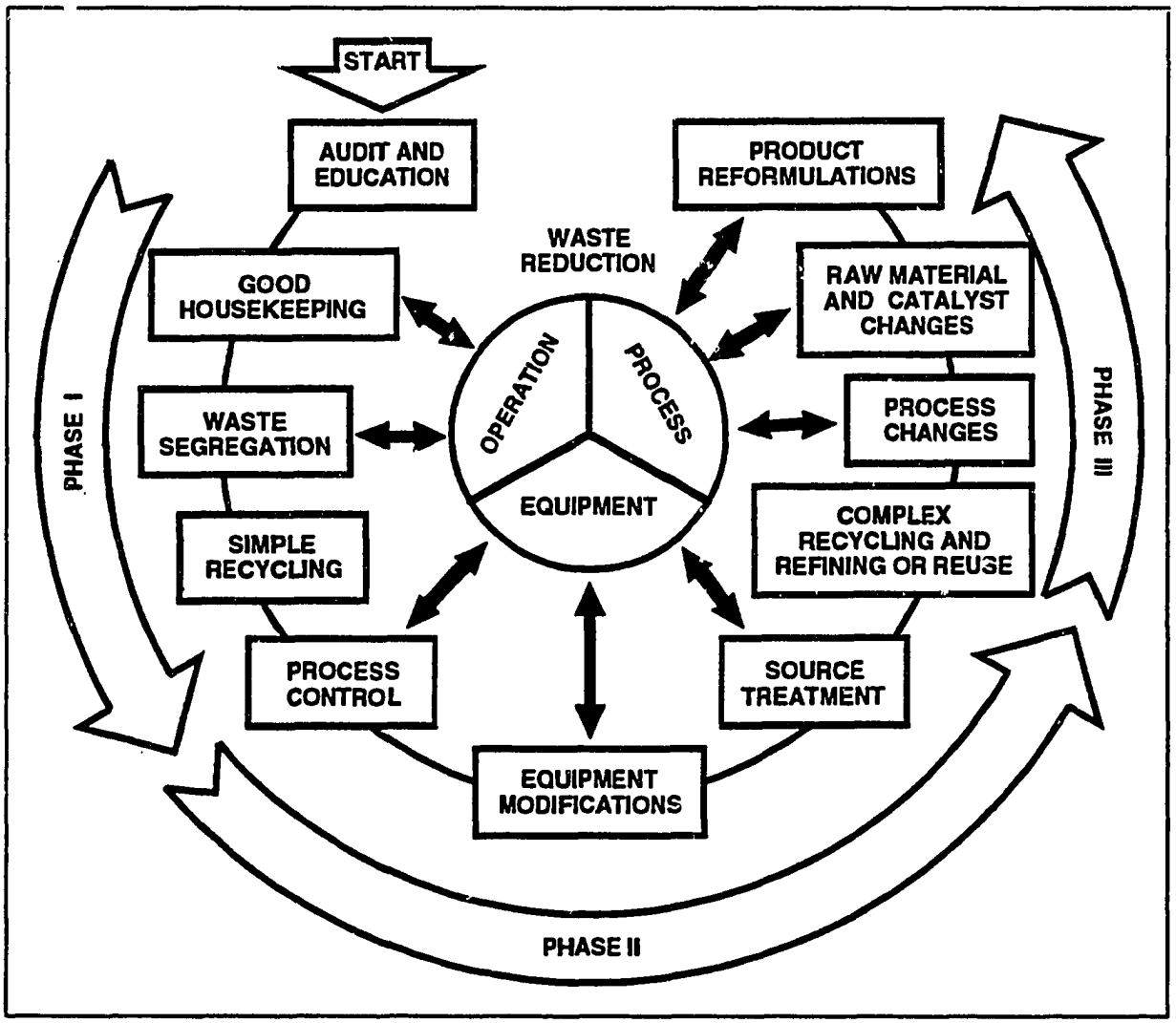
pollution prevention technologies, each should be evaluated and perhaps modified in the context of the country in question.

Implementation Issues

Many of these pollution prevention measure are complementary and can fit into an overall pollution prevention program. Each measure requires varying levels of hard and soft technology transfer. Aside from their compatibility with existing technology or other pollution prevention initiatives, the measures should also be viewed with respect to the political and economic barriers to technology transfer.

Figure 1 divides pollution prevention into three separate phases that have increasing complexity and decreasing returns on investment. Phases I, II, and III concentrate on: modifying a facility's operations,

FIGURE 1. WASTE REDUCTION FLOW DIAGRAM



Source: Berglund, R.L., Brown and Root Braun, and C.T. Lawson. 1991. "Preventing Pollution in the CPI." *Chemical Engineering*, September. Union Carbide Chemicals and Plastics Company.

modifying its equipment, and changing industrial processes. Phase I options, such as education, waste reduction audits, waste segregation and improved housekeeping, are relatively simple and cost effective options for developing countries. Minimal "hard" technology transfer is needed at this level. Both hard and soft technology transfer become increasingly difficult in the equipment and process phases.

Much of the technology for more complex pollution prevention processes (and thus, hard technology transfer) is in the hands of the U.S. private sector. As a result, it may be difficult for governmental agencies such as USAID to control the cost and destination of that technology.

Private corporations that develop, patent, and distribute new pollution prevention products may not wish to market their technologies in developing countries, particularly if this presents additional financial or technological risks. If developing countries initiate specific pollution prevention measures that require technology from abroad, the private sector in industrialized countries needs to be willing to provide the necessary technologies. Other issues, such as compatibility of new technologies with existing procedures, equipment, and waste streams; and the availability of technical skills and training, also should be addressed before complex changes that require significant hard technology transfer.

Issues in technology transfer also apply to the agricultural sector. Before extensive hard technology is introduced, such as complex irrigation mechanisms to save water and reduce erosion, efforts should focused on practices that reduce pesticide use, erosion, and other problems. Again, the preliminary stages are simple, low technology options that change the operation of a farm, such as educating workers on the correct application of suitable pesticides.

The potential difficulties with hard technology transfer suggest that simple modifications should take first priority in developing countries. USAID should help developing countries design long term plans for equipment and process changes but focus early efforts on characterizing plant operations and waste, and improving housekeeping, waste segregation, simple recycling, and education. Modifying operations may require minimal hard technology transfer and can be used to establish a positive relationship between the donor agency and local industry. Subsequently, efforts to evaluate and implement more capital intensive pollution prevention technologies may be more effective and successful in the long term.

In addition to possible technological and political barriers in the U.S. and the developing nation, donors should consider the international system in which these transfers will be taking place, and the long term effect on relations. Will the proposed technology transfer foster continuing, and perhaps greater dependence on industrialized countries for environmental management tools? Does the transfer hinder a developing nation's freedom to respond to certain political or environmental situations? By addressing these issues early in policy dialogue, donor agencies foster a realistic (and increasing) level of autonomy in developing nations, and maintain healthy relationships.

CHAPTER SIX:
USING INSTITUTION BUILDING TO PROMOTE POLLUTION PREVENTION IN USAID PROGRAMS

Overview

Successful implementation of pollution prevention requires coordinated effort by all sectors of society. Industry, government, academia, and the public at large all have important roles to play. The purpose of institution building is to provide the skills and resources needed so organizations and individuals can all do their part.

This chapter demonstrates how USAID can help build institutional capacity for pollution prevention in host countries. It describes the role of each sector in preventing pollution and what is required to fulfill each role. It also discusses the means available to USAID to help build these capabilities.

Options for Improving the Institutional Capacity for Pollution Prevention by Sector

Private Sector

Industry, the most visible source of hazardous waste production, takes the largest role in prevention. Industrial managers need to characterize their wastes, make changes to reduce these wastes, and recycle or reuse those which cannot be eliminated by standard prevention techniques. Industries in the U.S. and other developed nations have made some significant progress in all of these areas.

However, these tasks are not simple, particularly in developing countries where technological expertise and resources are often scarce. Many developing country industries lack the environmental awareness to identify prevention needs, the technical expertise to implement prevention measures, and the resources needed to buy and maintain appropriate technologies. USAID can help developing country industries with pollution prevention by educating both industry and the government on the:

- type, quantity, and toxicity of wastes produced, as well as the sources of those wastes in the production process (could be obtained from a basic waste reduction audit)
- environmental hazards associated with the release of various pollutants
- simple, low maintenance environmental technologies and options for obtaining them
- systems for collecting, tracking, and analyzing production data
- methods for calculating potential savings from pollution prevention initiatives
- compatibility of industrial culture and organization with pollution prevention objectives

Pollution prevention programs should also focus on agricultural non-point source pollution. Many of the agricultural pollution prevention techniques, such as proper pesticide application, crop rotation, integrated pest management, and erosion control can be achieved through education, outreach, and incentive programs. Techniques specific to a given climate may suit a variety of developing nations. This would allow USAID to develop guidelines for specific local conditions, including climate, type of crop, and method of irrigation.

Pollution prevention techniques for agriculture should be covered at universities or institutions that offer agricultural programs. However, outreach efforts to local and regional farming communities may be more effective. This could be accomplished through USAID missions' contacts with local, regional and national organizations, such as churches and NGOs. This builds the expertise, knowledge, and involvement of existing institutions. These institutions may also raise awareness within multinationals that often control agricultural practices.

Government

The government, through policy development, enforcement, and leadership, can be an important promoter of pollution prevention. Government responsibilities include identifying problems and setting priorities; removing policies that work against pollution prevention; and encouraging prevention by providing assistance and instituting environmentally sound regulatory and incentive systems.

USAID can help host country governments with a variety of measures aimed at environmental improvements and institution building. These may include efforts to:

- remove political and economical barriers to pollution prevention
- evaluate and improve the position of environmental agencies and different interest groups, as well as enforce regulations
- evaluate policy options, including an accurate account of human health and natural resource issues
- collect and analyze industry and environmental data
- provide training, incentives, and awareness programs
- conduct facility compliance audits
- conduct and analyze environmental assessments
- perform risk analysis for siting facilities and emergency planning

Government agencies in developing countries often have limited resources and may be unable to complete all the above tasks. Priority should be given to removing political and economic barriers to pollution prevention, and improving the ability of environmental agencies to implement and enforce regulations or programs. Later, if resources allow, collecting data, and providing education can be added. Complex risk assessments would most likely be too time consuming and resource intensive, and are unlikely to be an effective tool for promoting pollution prevention in developing countries. The above options for government action should be judged in the context of each host country.

Academic Institutions

Academic institutions play a vital role in developing the skills necessary for pollution prevention. Pollution prevention training can be included in a variety of fields. This means graduates entering business, research, government, agriculture, and other professions will have the needed background to implement prevention programs. Outside the academic setting, universities can foster pollution prevention by providing technical assistance, conducting workshops, and spreading information to local organizations and public interest groups.

To provide these services, academic institutions can:

- increase the number of environmental professionals such as chemical engineers
- expand the scope of existing curricula and design additional courses and degrees to include pollution prevention, particularly at the graduate level
- generate a pollution prevention library to enhance awareness of students and instructors, as well as the media and public at large

To sustain a program, university instructors and researchers need to learn the technical, policy and economic aspects of pollution prevention. USAID can help universities in developing countries by "training the trainers": educating university staff in the technical skills needed by students in industrial technology, hygiene, agriculture, and other relevant fields. USAID also should help university officials and professors understand the economic and environmental benefits of pollution prevention.

Public

In developed countries, the public can be an important force for pollution prevention. People demand environmental protection and exercise their influence with voting and purchasing decisions, to which government and industry often respond. However, in developing countries, governments may not be democratically elected, many industries are either multinationals or monopolies, and consumers are often poor. Despite this, public pressure can still be an effective tool for promoting and implementing pollution prevention programs. Information that can be made available to the public includes:

- household prevention measures
- environmental and health hazards associated with pollution
- types and quantities of wastes released by company and region
- citizens' rights and means of monitoring and influencing government activities concerning the environment

Implementation Options

Funding Conditionality

Before 1987, the Kemp-Kasten Amendment limited USAID's ability to place conditions on funding to help reach program goals. Now, it is widely used and often considered a necessary step to gain host country support for reforms (USAID, 1989). Put simply, funding conditionality sets down actions that host country governments must take in order to get further funding. For example, to enhance the role of environmental ministries, USAID could require environmental assessments of development projects before giving any support. Similarly, training programs and pollution prevention could be conditions of technology transfer to industry.

The challenge in setting conditions for funding is determining what requirements and degree of flexibility will be most effective. This is complicated when other donors are involved, due to the extra time and negotiations required to reach a consensus.

Access to Environmental Literature and Databases

Providing literature and databases is a fairly cheap way to foster pollution prevention. For that reason, it is an appropriate first step in institution building. The U.S. has information in the form of manuals, fact sheets, databases, and so on. USAID can package and issue these materials as part of its development programs. In doing so, attention should be given to the culture, education, language needs and technology level of the intended audience. Industry and government would benefit from receiving information on both the economic and technical aspects of pollution prevention.

The following are examples of information sources that would help establish prevention programs.

Literature:

- Guidance for conducting waste reduction audits. These are available from several sources, including the Hazardous Waste Research and Information Center and the U.S. Environmental Protection Agency.

- Fact sheets on the chemical composition of waste materials and the environmental and health hazards they present. Such information is available from the World Health Organization's health criteria documents, the Asian Development Bank, and other sources of toxicological literature (such as the EPA-Office of Water Effluent Guidelines).

- Guidelines for developing economic policies for sustainable development planning, issued, for example, by the Asian Development Bank.

- United Nations Industrial Development Organization in Vienna keeps reports of experts who have investigated individual manufacturing facilities in participating developing nations. These are a major untapped source of information.

- EPA's Facility Pollution Prevention Guide provides information on how a facility may design, evaluate, adjust, and maintain a pollution prevention program, as well as how to conduct a detailed assessment of production processes and waste reduction alternatives.

Databases:

- ICPIC (International Cleaner Production Information Clearinghouse). Developed in 1989 by UNEP/IEO with assistance from USEPA, this system contains a message center, bulletins of the latest cleaner production news worldwide, a calendar of events, case studies, a bibliography of document abstracts, and a list of experts worldwide. The service is free.

- PPIC (Pollution Prevention Information Clearinghouse). This database is administered by USEPA and provides case study information on specific pollution prevention initiatives.

- PACT (Pollution Abatement and Control Technology). This database was developed by UNEP/IEO to help more industrialized developing countries select and procure appropriate environmental technologies.

- APELL (Awareness and Preparedness for Emergencies at the Local Level). This program was started in 1988 by UNEP/IEO to minimize the occurrence of industrial accidents.

- NETT (Network for Environmental Technology Transfer). This system was developed by UNIDO. It is designed to put sellers and purchasers of environmental technologies in contact with one another.

- IPCS (International Programme on Chemical Safety). Established in 1980 by WHO, UNEP, and ILO, this system provides information on the risks that certain chemicals pose to human health and the environment.

Some of these sources may be difficult for developing country industries to apply to their own situations. However, USAID could help select and interpret useful literature during various stages of a pollution prevention initiative. For example, the audit guidance and fact sheets on chemical composition may help with preliminary efforts such as waste characterization and waste reduction audits.

Workshops and Training

Workshops, training, and incentive programs are an active approach to institution building, and can involve participants in hands-on education. Pollution prevention programs can be held in regions where

there is a high concentration of polluting industries. Where regional training centers do not exist, universities and research institutes are inexpensive alternatives.

Training teams can include expatriate and local experts from a variety of specialties such as engineering, law, and environmental science. Programs may be offered for all sectors of society and individuals at all levels of employment. However, "training the trainers" would probably be the best use of USAID resources. Representatives of trade associations who receive training can, in turn, train other members of their organizations. Likewise, NGO representatives can spread information to their constituents.

Support Programs

Exchange programs can offer training to build institutions in the industrial and agricultural sector. Sending experienced specialists from the U.S. to work with industry managers in developing countries is one of the best ways to recommend pollution prevention techniques and help with their implementation.

An example of a successful exchange program is the International Environment and Development Service (IEDS), begun in 1983 by the World Environment Center in cooperation with USAID. IEDS sends U.S. industry volunteers to work with petrochemical, chemical, paper, and manufacturing facilities in developing nations. Volunteers identify environmental problems, recommend remedial action, and provide training. Whitman Bassow, president of the WEC, says of the program:

> Many plants in developing countries do not have the technical resources or trained people to evaluate manufacturing processes in terms of environmental health and safety, environmental control and emergency response management. The service provided by the World Environment Center, USAID and American industry helps meet this important management need (Chase, 1987).

Joint Programs with Non-Governmental Organizations

Non-governmental organizations (NGOs) represent a wide variety of groups that work independently of government. They include private agencies in developed countries as well as indigenous groups, religious organizations, and citizens' groups. Many have in common a people-to-people approach to development. NGOs can work on a small scale at the grass roots level.

Due to their knowledge of the local, regional and national infrastructure, USAID missions may be best suited to involve NGOs in pollution prevention. NGOs can help raise environmental awareness in areas that may not be accessible to USAID as an outside agency.

CHAPTER SEVEN:
CONCLUSIONS AND SUGGESTED PROJECTS

Conclusions

Pollution prevention offers lower industrial costs, reduced risks to public health, resource conservation, and improved environmental quality for developing countries. However, for success, a supportive framework is necessary. In Table 7-1, seven conditions that contribute to the success of polluti on prevention are identified. USAID can help establish these conditions using the three primary support techniques. Together, policy dialogue, technology transfer, and institution building can help a developing country design and carry out a comprehensive strategy.

Traditional approaches to environmental management tend to be sectoral and fragmented. This has disadvantages, since activities in one sector may be undermined by activities in another. For example, efforts to reduce waste and increase productivity in the agricultural sector cannot stop at the farm boundary. Industrial emissions, urban runoff, or need for firewood may all be damaging farmland. In another example, efforts to reduce water pollution by burning waste may only result in the shift of pollutants to the air. A comprehensive approach addresses the relationship between different economic and political sectors and cross-media impacts. It is the best means of reducing wastes and improving overall environmental quality.

Pollution prevention is an excellent means for addressing a variety of cross-sectoral, cross-media environmental issues. By reducing waste and pollution at the source, potential impacts to human health and environmental resources are reduced. In the long term, pollution prevention is a much more cost effective option for improving environmental quality. If governments, NGOs, and—most importantly —industry, are educated on the benefits of this approach and given tools for implementation, developing countries will save financial and natural resources. USAID can help build the capacity to carry out cross-media management strategies such as pollution prevention.

Suggested Projects

Project One: Develop Pollution Prevention Guidelines

Pollution prevention guidelines for project implementation may be a useful reference. Agency staff, particularly decision-makers in the field, need to be aware of the opportunities, techniques, and benefits of pollution prevention. Appropriate guidelines with illustrations of implementation options and case study examples would provide this information. An index of pollution prevention options would help identify the most effective choices, given the cultural and infrastructure characteristics of a particular host country (see Hirschhorn, 1993).

TABLE 7-1: SUPPORT OPTIONS FOR POLLUTION PREVENTION INITIATIVES

Support Options			
Factors Affecting Pollution Prevention Implementation	**Policy Dialogue**	**Technology Transfer**	**Institution Building**
Environmental Awareness	1) Information and training for policymakers	1) Identify wastes and their impact through the audit process	1) Awareness building for all sectors through training and outreach services
Technological Capabilities		1) Transfer of prevention technologies 2) Training for technology use and maintenance 3) Materials handling procedures	1) Training for technology use and maintenance 2) Awareness of occupational hazards
Policy Framework	1) Advocate removal of policy distortions 2) Establish regulatory and market based incentives		1) Skills for policy development (e.g., risk/impact analyses, resource accounting
Enforcement Capabilities	1) Identify enforcement needs required for compliance	1) Pollution detection/monitoring devices to verify compliance	1) Skills to conduct compliance audits
Data Management	1) Identify data requirements for policy planning and enforcement	1) System to house and analyze data 2) Pollution detection devices to collect environmental data	1) Workshops on using data to promote pollution prevention
Financial Resources	1) Advocate revenue raising policy options 2) Funding assistance conditional on policy reform	1) Potential reduction in operating costs 2) USAID funded training/outreach services 3) Discounted technologies	1) USAID funded training/outreach services
Incentives	1) Encourage government leadership role 2) Advocate incentive programs (e.g., financial rewards, positive recognition)	1) Reduced operating and other costs, identified in the audit process	1) Heightens public awareness and thus demand for clean products and legislative protection

However, these guidelines should be designed so that they may be modified to account for country specific variations.

USAID could develop several sets of guidelines that apply to a group of host countries with similar development issues, economies, climates, and infrastructure. For example, numerous countries in sub-Saharan Africa could follow similar guidelines for agricultural and industrial pollution prevention.

Project Two: Develop Pollution Prevention Protocols for Policy Dialogue

Policy dialogues are an effective way for USAID to encourage the development of policies that support pollution prevention. Specifically, the goal of these dialogues is to enhance environmental awareness, advocate the removal of policy distortions, and promote policies that encourage waste reduction. The task for USAID mission officers is to present issues, options, and recommendations to a variety of industrial, agricultural, and governmental representatives.

The Agency could develop protocols for industry and government that present relevant information in a convincing format. They should summarize complex issues, motivate host country policymakers, and guide the dialogue. A clear agenda and adequate tools for presentation will facilitate a successful policy dialogue. Computer presentation may be a powerful tool for illustrating economic costs and benefits for government and industry at local, regional and national levels. So, too, are case studies.

Protocols tailored to dialogue with government officials at the national level will contain an entirely different set of problems, issues, and benefits than those for local officials or industrial managers.

Project Three: Conduct Pilot Programs

Pollution prevention is a new concept, particularly in developing countries. The U.S. has developed some effective industrial technologies, as well as regulations that promote waste reduction. However, we cannot assume these will be the best options for developing countries. Thus, before implementing extensive programs abroad, it would be useful to conduct pilot programs to test alternative approaches.

Pilot projects are a valuable opportunity to:

- test the effectiveness of various pollution prevention instruments in different host country settings
- collect data and calculate savings due to prevention
- set a well-documented and easily replicated example for other international donor agencies
- provide a positive example as an incentive for host country government and industry to start their own programs

Pilot programs should concentrate on industrial or agricultural managers, and changing simple procedures that do not require significant technology transfer or expense. The options in Phase I of the pollution prevention process, as described in Chapter Five (such as, housekeeping and simple process

modifications), should be the focus of pilot programs. If successful, additional steps may be taken with greater confidence.

Project Four: Incorporate Pollution Prevention in the Environmental Review Process

USAID is required by the Federal Assistance Act to conduct an environmental review of all projects as part of the approval process. Incorporating pollution prevention in these existing procedures would be an appropriate first step in developing an Agency strategy for pollution prevention.

The benefits of conducting a pollution prevention review during project design include:

- Agency-wide consistency in program goals
- prevention of cross-media environmental degradation
- identification of pollution prevention opportunities for projects in all program areas

Project Five: Design and Conduct Pollution Prevention Workshops

USAID can help educate managers on the benefits of pollution prevention, basic waste reduction techniques, and managerial changes through workshops. This can promote immediate changes through programs that are specific to a particular region or industry. This activity would be most effective if managed by country missions that know the distribution and nature of national, regional, and local industries and agriculture.

Workshops also should be directed at educational institutions and NGOs. By "training the trainers" at universities and technical schools, USAID can promote a more thorough dissemination of information on pollution prevention. NGOs may be able to incorporate information on pollution prevention into their outreach programs. Improving the environmental expertise at both educational institutions and NGOs will help create a more sustainable base of knowledge on pollution prevention.

Project Six: Establish Pollution Prevention 'Priority Areas'

USAID could select regional or international "priority areas" for pollution prevention efforts based on industrial pollution levels, existing infrastructure, and the political and economic climates. These areas could be experiencing significant levels of environmental deterioration and, so, would benefit from prevention programs. In addition, some developing countries may be more politically receptive to new environmental management approaches. USAID may be able to initiate programs with greater ease and effectiveness in areas or nations that have both of these characteristics. This initiative could be used simply to prioritize pollution prevention programs and allocate resources, as well as select sites for pilot programs.

Project Seven: Incorporate Pollution Prevention Initiatives into Development Assistance (DA) Programs

Instead of developing new pollution prevention programs, educational and technological initiatives could be incorporated into existing DA programs. Pollution prevention initiatives could be incorporated into:

- agricultural and rural development—to improve education, pesticide use, erosion control, and so on
- education and human resource development—to educate government officials, industry managers and representatives, NGOs, and university personnel
- private sector, environment, and energy activities—to promote waste reduction audits and appropriate technology transfer for existing or potential industries
- private enterprise—to incorporate conditional funding mechanisms into loans or subsidies to help new agricultural or industrial enterprises with a cost saving pollution prevention plan

By using existing programs to promote pollution prevention, USAID can stretch financial resources, and increase cross-sectoral communication and coordination.

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